FORM PTO-1390 (rev. 12-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

# TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

| ATTORNEY DOCKET NUMBER | U.S. APPLICATION NO. (IF KNOWN) |
|---|---|
| TRW(EHR)4846 | 09/554025 |

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |
|---|---|---|
| PCT/EP99/06590 | 7 September 1999 | 10 September 1998 |

TITLE OF INVENTION

BALL-AND-SOCKET JOINT

APPLICANT(S) FOR DO/EO/US

DORR, Christoph

Applicant Herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 317(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371 (c)(2)).
7. ☒ Amendment to the claims of the International Application under PCT Article 19 (35 U.S.C. (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau)
   b. ☐ have been transmitted by the International Bureau
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ Have not been made and will not be made
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. (c)(3))
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. (c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11 to 16 below concern document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information, as listed:

EXPRESS MAIL LABEL # EK 421 338 157 US

on 5-8-00 Teresa Razone

422 Rec'd PCT/PTO 08 MAY 2000

| U.S. APPLICATION NO. (if known) | INTERNATIONAL APPLICATION NO. | ATTORNEY DOCKET NO. |
|---|---|---|
| 09/554025 | PCT/EP99/06590 | TRW(HER)4846 |

17. ☒ The following fees are submitted:

| | CALCULATIONS PTO USE ONLY |
|---|---|
| **BASIC NATIONAL FEE (37 CFR 1.492(A)(1)-(5)):** | |
| Search Report has been prepared by the EPO or JPO $ 840.00 | |
| International Preliminary Examination fee paid to USPTO (37 CFR 1.482) $ 670.00 | |
| No international preliminary examination fee paid To USPTO (37 CFR 1.482) but international search Fee paid to USPTO (37 CFR 1.445(a)(2)) $ 760.00 | |
| Neither international preliminary fee (37 CFR 1.482) Nor international search fee (37 CFR 1.44 (a)(2) Paid to USPTO $ 970.00 | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied Provisions of PCT Article 33 (2)-(4) $ 96.00 | |
| **ENTER APPROPRIATE BASIC FEE AMOUNT =** | $ 840.00 |
| Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 Months from the earliest claimed priority date (37 CFR 1.492(e)) | $ |

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | |
|---|---|---|---|---|
| Total Claims | 10- 20 | | X $ 18.00 | $ |
| Independent Claims | 1 - 3 | | X $ 78.00 | $ |
| MULTIPLE DEPENDENT CLAIM(S) (if applicable) | | | + $260.00 | $ |
| **TOTAL OF ABOVE CALCULATIONS =** | | | | $ 840.00 |
| Reduction by ½ for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9,1.27,1.28). | | | | $ |
| **SUBTOTAL =** | | | | $ 840.00 |
| Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR .492(f)). | | | | $ |
| **TOTAL NATIONAL FEE =** | | | | $ 840.00 |
| Fee for recording the enclosed assignment (37 CFR 1.21 (b)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). $40.00 per property + | | | | $ |
| **TOTAL FEES ENCLOSED =** | | | | $ 840.00 |
| | | | **Amount to be Refunded:** | $ |
| | | | **Amount to be refunded:** | $ |

a. ☒ A check in the amount of $ 840.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **20-0090**. A duplicate of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.127 (a)or(b)) must be filed and granted to restore the application to pending status.

**SEND ALL CORRESPONDENCE TO:**
Thomas L. Tarolli
TAROLLI, SUNDHEIM, COVELL, TUMMINO & SZABO
1111 Leader Building
Cleveland, Ohio 44114

SIGNATURE: _____

NAME : Thomas L. Tarolli

REG. No. : 20,177

Form PTO-1390 (Rev. 12/98)

PCT

Express Mail Label # EK 421338157 US

I hereby certify that this paper or fee is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated below and is addressed to the Commissioner of Patents and Trademarks, Washington D.C. 20231

Teresa Ragone
Signature Teresa Ragone

5-8-00
Date of Deposit

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| Applicant | : | Christoph Dorr |
| International Appln No. | : | PCT/EP99/06590 |
| International Filing Date | : | 7 September 1999 |
| Priority Date(s) Claimed | : | 10 September 1998 |
| Title | : | BALL-AND-SOCKET JOINT |
| Attorney Docket No. | : | TRW(EHR)4846 |

Cleveland, Ohio 44114
May 8, 2000

**BOX PCT**
Comm. Patents and Trademarks
Washington, D.C. 20231

**PRELIMINARY AMENDMENT**

Sir:

Prior to examination of the above-identified application, entry of the present amendment is respectfully requested.

**IN THE CLAIMS:**

Claim 4, line 1, please delete the words "at least one of Claims 1 to 3", and insert --claim 1--.

Claim 5, line 1, please delete the words "at least one of Claims 1 to 4", and insert --claim 1--.

Claim 6, line 1, please delete the words "at least one of Claims 1 to 5", and insert --claim 1--.

Claim 7, line 1, please delete the words "at least one of Claims 1 to 6", and insert --claim 1--.

Claim 8, line 1, please delete the words "Claims 6 and 7", and insert --claim 6--.

Claim 9, line 1, please delete the words "at least one of Claims 1 to 8", and insert --claim 1--.

Claim 10, line 1, please delete the words "at least one of Claims 1 to 9", and insert --claim 1--.

**REMARKS**

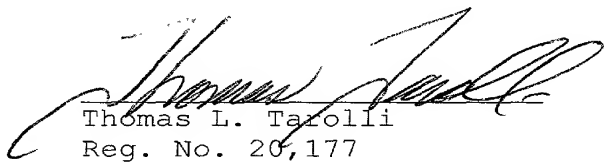
Examination of the above-identified application in view of the present amendment is respectfully requested.

The present amendment before action removes the multiple dependency appearing in the claims.

An early action on the merits is respectfully requested.

Please charge any deficiency or credit any overpayment in the fees for this matter to our Deposit Account No. 20-0090.

Respectfully submitted,



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# Ball-and-Socket Joint

The invention relates to a ball-and-socket joint, intended particularly for motor vehicles, having a joint pin provided with a joint ball, a plastic joint housing into which is inserted a bearing shell for the rotatable, and to a limited extent tiltable, support of the joint ball, and a metal ring to positively lock the bearing shell within the joint housing.

Such ball-and-socket joints are known, for example, from DE 195 42 071 A1. The preferably plastic bearing shell inserted into the joint housing is fixed within the joint housing by a snap connection.

The object of the invention is to further develop a ball-and-socket joint of the initially described type to make it suitable, without an appreciable increase in costs, for increased static and dynamic loads in the direction of the joint axis and for use as a radial or axial joint.

This object is attained by the invention in that the metal ring is embedded within the joint housing and has a radially inwardly bent end segment located in the area of the opening in the joint housing provided for the passage of the joint pin.

This "injected" metal ring, which is embedded in the joint housing during its production, i.e., by extrusion coating during the production of the joint housing, is used on the one hand to positively lock the bearing shell within the joint housing by reshaping its end segment such that the ball-and-socket joint can support higher axial joint pin loads. On the other hand the metal ring reinforces the plastic joint housing such that a radial expansion of said joint housing upon axial loading of the joint pin is prevented, which further increases the axial loading capacity of the ball-and-socket joint according to the invention. Since the metal ring can be readily integrated in the joint housing by extrusion coating during the production of the joint housing, the aforementioned advantages compared to

conventional ball-and-socket joints can be achieved without appreciable cost increases.

According to a further feature of the invention, the metal ring, on its end that is extrusion coated with the material of the joint housing, is provided with a radially outwardly angled flange to fix the metal ring securely within the joint housing. In a preferred embodiment of the invention, the flange protrudes at an approximately 90° angle from a cylindrical center part of the metal ring.

In a preferred embodiment of the invention, the inside diameter of the cylindrical center part of the metal ring approximately corresponds to the outside diameter of the bearing shell, so that the cylindrical center part of the metal ring simultaneously serves as a precise guide for the bearing shell.

To enhance the strength of the plastic joint housing, the cylindrical central part of the metal ring ends approximately in the area of the ball equator of the joint housing such that the metal ring strengthens the housing along its critical part against radial expansion.

To permit problem-free expansion of the bearing shell as the joint ball is inserted, the invention furthermore proposes to provide the bearing shell along its pin-side area with slits extending up into the area of the ball equator. A further feature of the invention proposes to provide the bearing shell along its head-side area facing away from the joint pin with indentations extending parallel to the joint axis to create flexible areas for play-free support of the joint ball. In a preferred embodiment the slits and indentations can be formed mutually offset in circumferential direction in the bearing shell.

In a preferred further development of the ball-and-socket joint according to the invention, the joint housing, in the area of its opening, is provided with a ring groove to fix the ball-side end of a sealing bellows.

Finally, the invention proposes to make the joint housing together with a chassis strut from plastic by injection molding as a single piece. This results in a particularly cost-effective production of such a component.

The drawing depicts an exemplary embodiment of a ball-and-socket joint according to the invention, in which:

Fig. 1 is a longitudinal section through a ball-and-socket joint during assembly and

Fig. 2 is a longitudinal section corresponding to Fig. 1 through a finally assembled ball-and-socket joint.

The ball-and-socket joint intended particularly for motor vehicles and shown by way of example comprises a joint pin 1 provided with a joint ball 1.1 as well as a joint housing 2 in which joint pin 1 via its joint ball 1.1 is rotatably and to a limit extent tiltably supported by means of a bearing shell 3. Joint housing 2 and bearing shell 3 are each made of a suitable plastic.

When joint housing 2 is produced by injection molding, a metal ring 4 an exemplary embodiment of which is shown in Fig. 1 and 2 is injected. In the examples shown, metal ring 4 comprises a cylindrical center part 4.1 extending from the opening of joint housing 2 up into the area of equator Ä of joint ball 1.1 which is in its zero position. At this end located within the area of equator Ä, a radially outwardly angled flange 4.2 is formed onto the cylindrical center part 4.1 of metal ring 4, which in the embodiment shown extends at an approximately 90° angle to the cylindrical center part 4.1. Since this flange 4.2 is enclosed by the plastic material of joint housing 2, metal ring 4 is securely anchored within joint housing 2.

With its other initially cylindrical end, metal ring 4 according to Fig. 1 protrudes from the opening of joint housing 2 provided for the passage of joint pin 1.

In the exemplary embodiment depicted in the drawing, the inside diameter of the cylindrical center part 4.1 of metal ring 4 corresponds to the outside diameter of bearing shell 3 such that metal ring 4 forms a guide for bearing shell 3.

After bearing shell 3 mounted on joint ball 1.1 has been inserted in joint housing 2, the end segment 4.3 of metal ring 4 is bent radially inwardly as shown in Fig. 2 from its initial position depicted in Fig. 1 such that metal ring 4 via its end segment 4.3 secures the position of bearing shell 3 within joint housing 2. This positively locked position of the bearing shell within joint housing 2 increases the static and dynamic loading capacity of the ball-and-socket joint in pullout direction of joint pin 1. This loading capacity of the ball-and-socket joint is further increased in that metal ring 4 injected into joint housing 2 secures joint housing 2 against expansion along the portion located between ball equator Ä and the opening.

In the example depicted in the drawing, bearing shell 3 along its pin-side area is provided with slits 3.1 extending up into the area of ball equator Ä. When bearing shell 3 is mounted on joint ball 1.1, these slits 3.1 permit an expansion of the ball-race type bearing surfaces formed by the portion of bearing shell 3 that extends between equator Ä and the opening for the joint pin.

To create flexible areas for play-free support of joint ball 1.1 in the head area of bearing shell 3, bearing shell 3 in its head-side area facing away from joint pin 1 is provided with indentations 3.2 extending parallel to joint axis L. In the depicted example, slits 3.1 and indentations 3.2 are formed mutually offset in circumferential direction in bearing shell 3.

To prevent moisture and dirt from getting into the interior of the ball-and-socket joint, a sealing bellows 5 is used, the pin-side opening of which is fixed in a ring groove of the joint pin 1 by means of a retaining ring 5.1. The ball-side opening of sealing bellows 5 is fixed by means of a retaining ring 5.2 at the end of joint

housing 2 surrounding the opening. For this purpose joint housing 2 is provided with a ring groove 2.1 as shown in Fig. 1.

List of Reference Symbols

| | |
|---|---|
| 1 | joint pin |
| 1.1 | joint ball |
| 2 | joint housing |
| 2.1 | ring groove |
| 3 | bearing shell |
| 3.1 | slit |
| 3.2 | indentation |
| 4 | metal ring |
| 4.1 | center part |
| 4.2 | flange |
| 4.3 | end segment |
| 5 | sealing bellows |
| 5.1 | retaining ring |
| 5.2 | retaining ring |
| Ä | ball equator |
| L | longitudinal axis |

Claims

1. Ball-and-socket joint, intended particularly for motor vehicles, having a joint pin provided with a joint ball (1.1), a plastic joint housing (2) into which is inserted a bearing shell (3) for the rotatable and to a limited extent tiltable support of the joint ball (1.1), and a metal ring (6) to positively lock the bearing shell (2) [sic] within the joint housing (3) [sic],
characterized in that,
the metal ring (4) is embedded in the joint housing (2) and has a radially inwardly bent end segment (4.3) located in the area of the opening in the joint housing (2) that is provided for the passage of the joint pin (1).

2. Ball-and-socket joint as claimed in Claim 1, characterized in that the metal ring (4) at its end that is extrusion-coated with the material of the joint housing (2) is provided with a radially outwardly angled flange (4.2).

3. Ball-and-socket joint as claimed in Claim 2, characterized in that the flange (4.2) protrudes at an approximately 90° angle from a cylindrical center part (4.1) of the metal ring (4).

4. Ball-and-socket joint as claimed in at least one of Claims 1 to 3, characterized in that the inside diameter of the cylindrical center part (4.1) of the metal ring (4) approximately corresponds to the outside diameter of the bearing shell (3).

5. Ball-and-socket joint as claimed in at least one of Claims 1 to 4, characterized in that the cylindrical center part (4.1) of the metal ring (4) ends approximately in the area of the ball equator (Ä) of the joint housing (2).

6. Ball-and-socket joint as claimed in at least one of Claims 1 to 5, characterized in that the bearing shell (3) in its pin-side area is provided with slits (3.1) reaching up to the area of the ball equator (Ä).

7. Ball-and-socket joint as claimed in at least one of Claims 1 to 6, characterized in that the bearing shell (3) in its head-side area facing away from the joint pin (1) is provided with indentations (3.2) extending parallel to the joint axis (L).

8. Ball-and-socket joint as claimed in Claims 6 and 7, characterized in that the slits (3.1) and indentations (3.2) are formed in the bearing shell (3) so as to be mutually offset in circumferential direction.

9. Ball-and-socket joint as claimed in at least one of Claims 1 to 8, characterized in that the joint housing (2) in the area of its opening is provided with a ring groove (2.1) to fix the ball-side end of a sealing bellows (5).

10. Ball-and-socket joint as claimed in at least one of Claims 1 to 9, characterized in that the joint housing (2) is made of plastic as one piece together with a chassis strut by injection molding.

Fig. 2

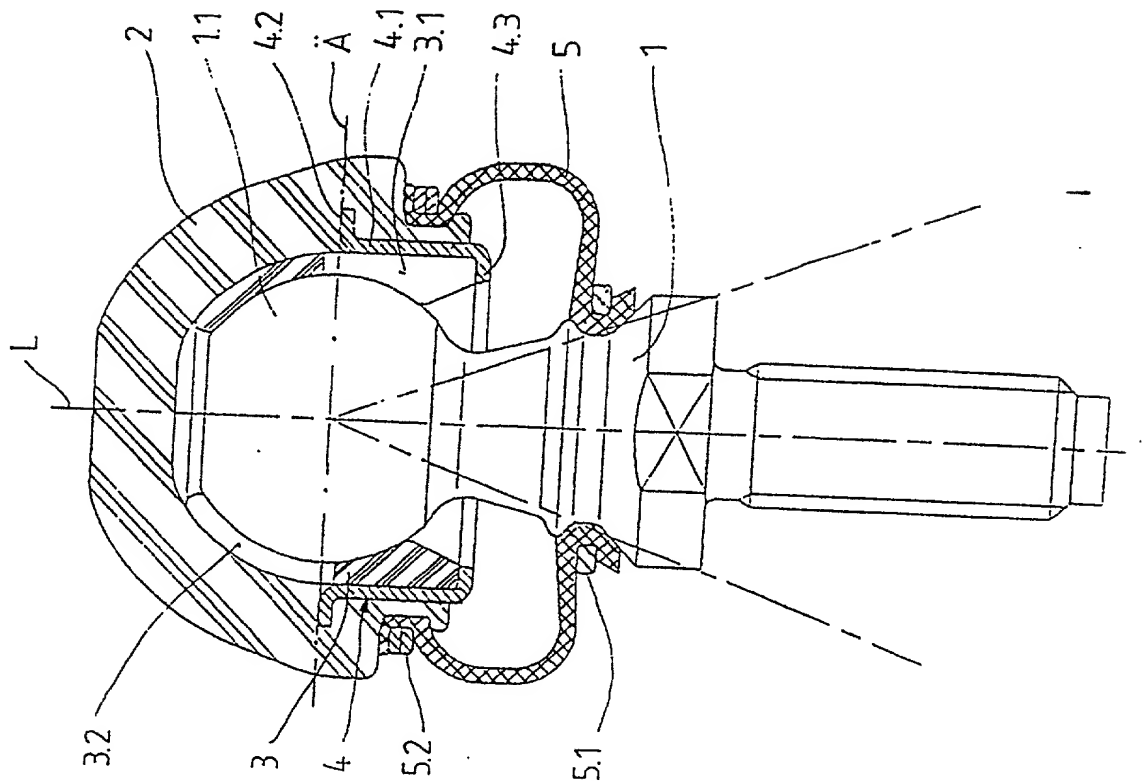
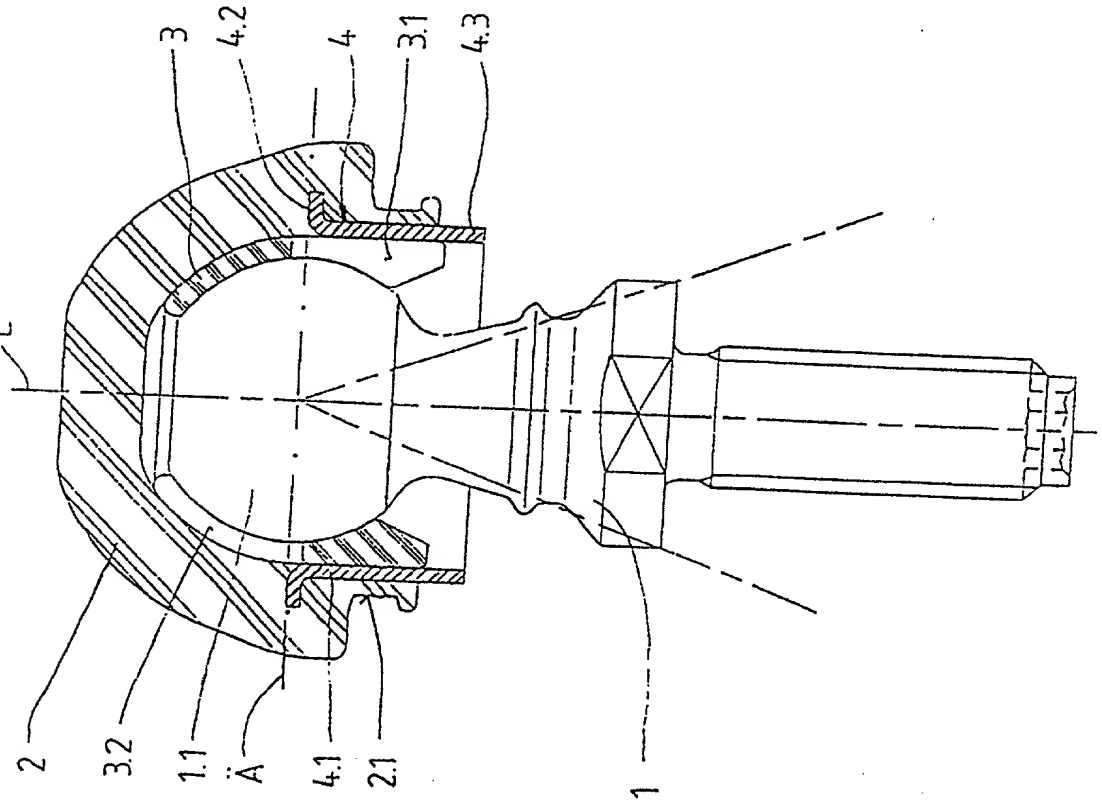



Fig. 1



**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION** Atty. Docket No. TRW (EHR) 4846

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

BALL-AND-SOCKET JOINT

the specification of which

(check one) ☐ is attached hereto.
☒ was filed on September 7, 1999 as PCT/EP99/06590 and May 8, 2000 as Application Serial No. 09/554,025
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

| (Number) | (Country) | (Day/Month/Year Filed) | Priority Claimed |
|---|---|---|---|
| DE 198 41 410.2 | GERMANY | 9/10/98 | ☒ Yes ☐ No |
| | | | ☐ Yes ☐ No |

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a)which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

| (Application Serial No.) | (Filing Date) | (Status-patented, pending, abandoned) |
|---|---|---|
| | | |
| | | |

Power of Attorney: As a named inventor, I hereby appoint the following attorneys: Thomas L. Tarolli, Reg. No. 20,177; Robert B. Sundheim, Reg. No. 20,127; Calvin G. Covell, Reg. No. 24,042; Barry L. Tummino, Reg. No. 29,709; Paul E. Szabo, Reg. No. 30,429; James L. Tarolli, Reg. No. 36,029; Ronald M. Kachmarik, Reg. No. 34,512; Richard S. Wesorick, Reg. No. 40,871; Maurice R. Salada, Reg. No. 26,502; Allan W. Vogele, Reg. No. 28,127; and Gary L. Hermanson, Reg. No. 34,349; each with full powers of substitution and revocation to prosecute this application and transact all business in the United States Patent and Trademark Office connected therewith.

SEND CORRESPONDENCE TO: ~~TAROLLI, SUNDHEIM, COVELL, TUMMINO & SZABO L.L.P. 1111 LEADER BLDG., 526 SUPERIOR AVENUE CLEVELAND, OHIO 44114-1400~~

DIRECT TELEPHONE CALLS TO: THOMAS L. TAROLLI (216) 621-2234

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1) Full name of sole or first inventor Christoph Dorr

Inventor's signature Ch Dorr Date Ch 3.4.00

Residence Kilianstraße 36, 46514 Schermbeck, Germany Citizenship ~~German~~ DE

Post Office Address Kilianstraße 36, 46514 Schermbeck, Germany

2) Full name of second inventor _____

Inventor's signature _____ Date _____

Residence _____ Citizenship _____

Post Office Address _____